

Fast Pressure-Sensitive Paint System for Production Wind Tunnel Testing, Phase I

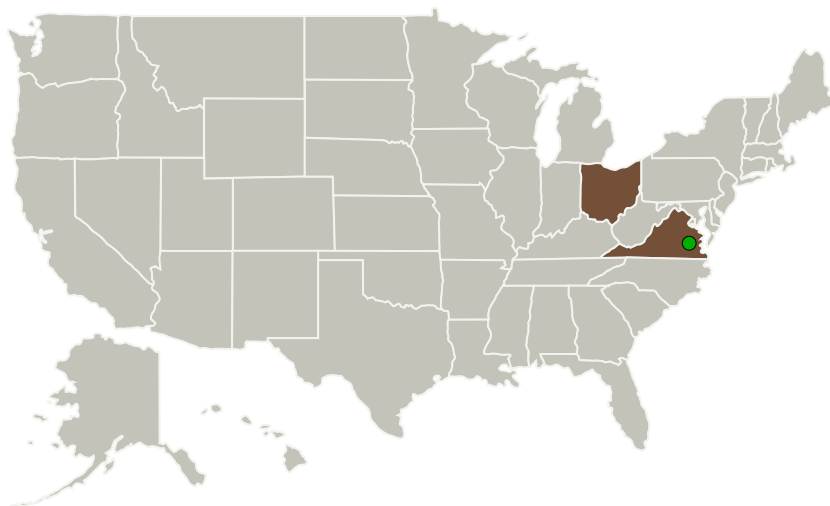
Completed Technology Project (2015 - 2015)



Project Introduction

Significant advances in the use of fast responding Pressure-Sensitive Paint have recently been achieved as demonstrated by a multi-camera fast PSP test conducted in the 16 foot transonic wind tunnel at AEDC. The unsteady pressure results from this test demonstrated excellent accuracy and spatial resolution, establishing the technical readiness of the fast PSP sensor. During the program, two issues were identified that would significantly improve the fast PSP system performance, 1) real-time data processing, and 2) acquisition of both mean and unsteady data using a single entry. Here we propose the continued development of the fast PSP system by addressing these issues. To enable real-time data processing, a system composed of a computer with a large block of memory, a multi-core processor, and several high end video cards (GPUs) has been assembled. Modern GPUs include thousands of floating point processors and large blocks of memory which enable parallel computations to be executed on individual images. Fast PSP data is an ideal application of this technology as many of the computations can be performed on each image independently. Preliminary tests by ISSI have demonstrated improvements of a factor of three to thirty in processing time using this approach. Acquisition of both mean and unsteady pressure during a single tunnel entry would increase tunnel productivity and can be used to improve the accuracy of the unsteady pressure data. Unfortunately, fast PSPs are generally very temperature sensitive which limits their use in acquiring mean pressure data. ISSI has recently developed a fast PSP formulation with low temperature sensitivity. This formulation will be optimized for use in large wind tunnels and enable acquisition of mean and unsteady pressure data using a single PSP.

Primary U.S. Work Locations and Key Partners



NASA SBIR/STTR Technologies
Fast PSP System for Production Wind Tunnel Testing
 PI: Dr. Jim Crafton, Innovative Scientific Solutions
 Bayview Office Proposal No. A-1.08-0002

Innovation

Fast PSP system coupled with new real-time data processing and analysis tools.

Data mining tools for analysis of fast PSP data.

Acquisition of both mean and unsteady pressure.

Work Plan

Construct a processing system with GPUs.

Develop fast data processing and data analysis software that utilize CUDA processing on the GPUs.

Modify fast PSP to operate with existing two-gate lifetime detection hardware.

Applications

Temporally and spatially resolved pressure for ground test facilities.

Insights of the hardware for flight test applications.

NON-PROPRIETARY DATA

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Organizations Performing Work	Role	Type	Location
Innovative Scientific Solutions, Inc.	Lead Organization	Industry	Dayton, Ohio
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations

Ohio	Virginia
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Project Transitions

June 2015: Project Start

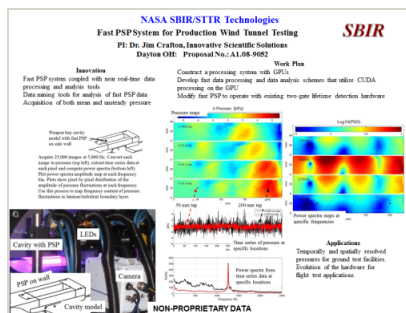
December 2015: Closed out

Closeout Summary: Fast Pressure-Sensitive Paint System for Production Wind Tunnel Testing, Phase I Project Image

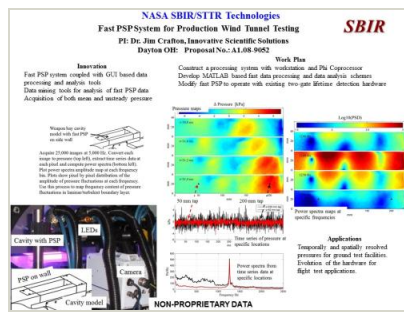
Closeout Documentation:

- Final Summary Chart Image(<https://techport.nasa.gov/file/138862>)

Images

**Briefing Chart Image**

Fast Pressure-Sensitive Paint System for Production Wind Tunnel Testing, Phase I
(<https://techport.nasa.gov/image/130043>)

**Final Summary Chart Image**

Fast Pressure-Sensitive Paint System for Production Wind Tunnel Testing, Phase I Project Image
(<https://techport.nasa.gov/image/126249>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Innovative Scientific Solutions, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Jim Crafton

Co-Investigator:

James Crafton

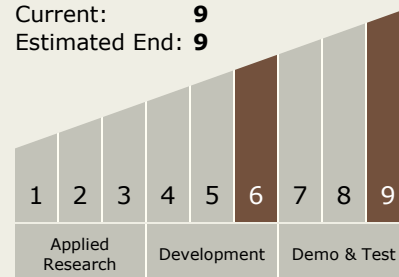
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Technology Maturity (TRL)

Start: 6
Current: 9
Estimated End: 9



Technology Areas

Primary:

- TX15 Flight Vehicle Systems
 - └ TX15.1 Aerosciences
 - └ TX15.1.8 Ground and Flight Test Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System